

CLAIMS

1. A method of selecting a motion vector for use in a motion estimation system, said motion vector defining movement of a block of pixels between a search window and a reference frame, said method comprising the steps of:

scanning a search window in a fixed order for a suitable match with an area of the reference frame such that each search position within a current row or column of the window is one pixel away from a previous search position;

defining a preferred point in the search window;

calculating a primary norm function with reference to the preferred point for a given position in each row or column;

calculating a norm function for each search position based on a linear increment of the primary norm function for the respective row or column;

calculating an Absolute Error (AE) for each search position, based on a difference between a given property of the search position and a position in the reference window; and

selecting a motion vector, the displacement of the motion vector defined in terms of the search position having the smallest AE, and when more than one search position has the same smallest AE, selecting the search position having the smallest norm function.

2. The method of claim 1 wherein the step of calculating the primary norm function for a given position includes the step of calculating the square of the distance between the preferred point and the current search point.

3. The method of claim 1 wherein the linear increment for a row or column is $(1+2X)$ or $(1+2Y)$ respectively, where X and Y refer to the respective coordinates of the current search position.

4. The method of claim 1 wherein a plurality of positions are searched simultaneously using a multiple systolic array arranged such that said plurality of positions are arranged in the same row or column.

5. The method of claim 4 wherein a pre-selected motion vector is determined on the basis of the AE calculations for said plurality of positions, and the motion vector is selected on the basis of the AE and norm functions of the pre-selected motion vectors.

6. The method of claim 5 wherein the calculated AE results for said plurality of positions are sorted according to the distance of their row or column position from the preferred point, and the pre-selected motion vectors are determined on the basis of the sorted AE results.

7. The method of claim 1 wherein the reference frame is one of a forward, backward, and interpolation frame as defined in MPEG standards.

8. The method of claim 1 wherein a Square Error (SE) calculation is performed in place of the Absolute Error (AE) calculation.

9. A motion estimation device for calculating a motion vector defining a displacement between a block of pixels in a search window and a block of pixels in a reference frame, including:

means for scanning a search window in a fixed order for a suitable match with an area of the reference frame such that each search position within a current row or column of the window is one pixel away from a previous search position;

means for defining a preferred point in the search window;

means for calculating a primary norm function with reference to the preferred point for a given position in each row or column;

means for calculating a norm function for each search position based on a linear increment of the primary norm function for the respective row or column;

means for calculating an Absolute Error (AE) for each search position, based on a difference between a given property of the search position and a position in the reference window;

means for selecting a motion vector, the displacement of the motion vector defined on the basis of the search position having the smallest AE, and when more than one search position has the same smallest AE, means for selecting the search position having the smallest norm function.

10. The device of claim 9, wherein the scanning means is configured to scan the search window pixels in a top-to-top down and left-to-right order.

11. The device of claim 10, wherein the means for calculating a norm value comprise one subtractor circuit, one square circuit, and two adder circuits.

12. The device of claim 9, wherein the means for selecting the search position having the smallest norm function comprise means for comparing the norm function associated with the search position of each of the same smallest AE.

13. The device of claim 9, further comprising means for selecting the reference frame to be one from among a forward frame, a backward frame, and an interpolation frame.

14. A method of selecting a motion vector for use in a motion estimation system, the motion vector defining movement of a block of pixels between a search window and a reference frame, the method comprising:

scanning a search window such that each search position is one pixel away from a previous search position;

calculating a primary norm function with reference to a preferred point for a given position;

calculating a norm function for each search position based on a linear increment of the primary norm function for a respective row or column;

calculating an Absolute Error (AE) for each search position; and

selecting a motion vector having a displacement defined in terms of the search position having the smallest AE and the smallest norm function.

15. The method of claim 14, further comprising selecting a reference frame from one of among a forward frame, a backward frame, and an interpolation frame.

16. The method of claim 14, wherein calculated AE results for a plurality of positions are sorted according to a distance of their row or column position from the preferred point, and a pre-selected motion vector is determined on the basis of the sorted AE results, the pre-selected motion vector is used for the selection of the motion vector and the AE and norm functions.